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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/966,157	09/28/2001	Isaiah O. Oladeji	Jessen 7-1-4/-75903-023	4091

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EXAMINER

GUERRERO, MARIA F

ART UNIT PAPER NUMBER

2822

DATE MAILED: 12/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/966,157

Applicant(s)

OLADEJI ET AL. *W*

Examiner

Maria Guerrero

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 November 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 1-5 and 26-29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☒ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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### **DETAILED ACTION**

1. This Office Action is in response to the Election and the Amendment filed November 14, 2002.

Claims 1-29 are pending.

### ***Election/Restrictions***

2. Applicant's election with traverse of Group I (claims 6-20) in Paper No. 5 is acknowledged. The traversal is on the ground(s) that the process relied upon in the restriction is not materially different than Applicants' claimed processes. This is not found persuasive because the example stated in the restriction requirement is simply that, an example. There are other materially different processes that could be used to form the claimed product; the mask layer could be formed by other methods including, surface modification treatment, laminating, screen-printing or others. Also, the requirement for searching of the process claim does not necessitate a search in the product art, process and product art have gain separate stature in the office. They are classified in two different art classifications and assigned to two different sets of Art Units. The examination of two independent inventions is considered to be a serious burden on the Examiner.

The requirement is still deemed proper and is therefore made FINAL.

3. Claims 1-5 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or

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linking claim. Applicant timely traversed the restriction (election) requirement in Paper No. 5.

4. Newly submitted claims 26-29 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: claims 26-29 drawn to semiconductor devices.

Since applicant is receiving an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 26-29 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Regarding claims 26-29, a "product by process" claim is directed to the product per se, no matter how actually made. In re Hirao and Sato et al., 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also In re Brown and Saffer, 173 USPQ 685 (CCPA 1972); In re Luck and Gainer, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and In re Marosi et al., 218 USPQ 289 (CAFC 1983).

#### ***Information Disclosure Statement***

5. The information disclosure statement (IDS) submitted on September 28, 2001 has been considered by the examiner.

#### ***Oath/Declaration***

6. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

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The oath or declaration is defective because:  
Non-initialed and/or non-dated alterations have been made to the oath or declaration. See 37 CFR 1.52(c).

### ***Specification***

7. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

### ***Claim Objections***

8. Claims 7 and 17 are objected to because of the following informalities: the term "carbide" is misspelled, in claims 7 and 17, line 2. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 6-20 and 24-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6-12, 19-20, and 25 recite "a predetermined depth"; the term predetermined rendered the claims indefinite.

Claims 24-25 recite "a predetermined width"; the term predetermined rendered the claims indefinite.

Claim 6 recites the limitation "said passivation barrier" in line 7. There is insufficient antecedent basis for this limitation in the claim.

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Claim 13 recites the limitation "the low-k dielectric layer" in line 6. There is insufficient antecedent basis for this limitation in the claim.

Claim 16 recites the limitation "the dielectric material" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 20 recites the limitation "the integrated circuit chip" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 6-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Usami (U.S. 6,274,483) in view of Chan et al. (U.S. 6,312,874).

Usami teaches a method of forming a dual damascene interconnect structure having a low-K dielectric material deposited over an underlying metal layer (col. 1, lines 8-11, col. 4, lines 1-10). Usami discloses forming a silicon dioxide film (or silicon carbide) (24) over the low-K dielectric material (23), forming a mask (35) (barrier mask film), forming a metallic mask film (37) over the mask (35) (Fig. 4A, col. 9, lines 62-67, col. 10, lines 5-22).

Furthermore, Usami teaches patterning a first and a second feature in the mask layer using a photoresist layer, etching a trench within the low-K dielectric material (23)

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and etching a via through the low-k dielectric material (23) to the underlying metal layer (21) (Fig. 4A-5D, col. 4, lines 15-65, col. 10, lines 23-40, 45-50, col. 11, lines 14-45).

Usami shows metallic mask film comprising: titanium, tantalum, tungsten, titanium nitride, and tantalum nitride (col. 5, lines 45-49). Usami discloses the first and second metal masks are stacked together to form the metal mask (Fig. 4C, col. 10, lines 15-22). Usami depositing a conductive metal within the via and the trench on the low-k dielectric material (Fig. 6A, col. 11, lines 53-60). In addition, Usami shows planarizing the conductive metal and removing the mask (Fig. 6A-6B, col. 11, lines 57-65).

Regarding claims 6-12, Usami does not specifically describe the silicon dioxide film 24 as part of the mask layer. Usami does not specifically show the barrier mask film being silicon nitride. However, Usami shows the silicon oxide film being selectively removed and subsequently selectively removing the low-K dielectric material (col. 8, lines 54-60).

In addition, Chan et al. discloses forming a first mask layer (52) (silicon oxide) on the low-K dielectric material (50), forming an intermediated mask layer (54) made of silicon nitride on the first mask layer (52) (col. 5, lines 10-15). Chan et al. also teaches the low-k dielectric material is still protected by the first mask layer (52) and the multiple layer mask (58) (Abstract, Fig. 3c-3e).

Regarding claims 13-25, Usami does not specifically show forming the metallic film as part of the mask layer to increase the etch selectivity of the mask layer with respect to the low-k dielectric material. However, one of the main objectives of Usami is to prevent the low-k dielectric material from being etched during the step of removing

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the photoresist. Usami selectively etches the low-k dielectric material (Abstract, col. 3, lines 60-67, col. 11, lines 34-40).

In addition, Chan et al. teaches etching each mask layer selectively without etching the rest of the layers and selectively etching the low-k dielectric material (Fig. 3a-3e, col. 5, lines 45-67, col. 6, lines 5-25).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Usami's process by specifying the use of the silicon oxide film as a protecting film and as a mask layer as taught Chan et al. and to specify the increase of etch selectivity of the mask with respect to the low-k dielectric material. The modification would provide a process of forming a good quality dual damascene structure using a multiple layer mask ensuring the protection the low dielectric constant material during the photoresist removal process and the via would maintain desired width minimizing misalignment. The combination is proper because both references are solved a common problem (Usami, col. 3, lines 64-67; Chan et al., Abstract, col. 3, lines 64-67).

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Huang et al. (U.S. 5,635,423) teaches a dual damascene process for multi-level metallization. Morrow et al. (U.S. 6,479,391) teaches a method of making damascene interconnect using a multilayer hard mask.




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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 703-305-0162.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 703-308-49055. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
Maria Guerrero  
Patent Examiner  
December 16, 2002